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Building Sensitising Terms to Understand Free-play in Open-ended Interactive Art Environments

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ABSTRACT

In this paper we introduce and discuss the nature of free-play in the context of three open-ended interactive art installation works. We observe the interaction work of situated free-play of the participants in these environments and, building on precedent work, devise a set of sensitising terms derived both from the literature and from what we observe from participants interacting there. These sensitising terms act as guides and are designed to be used by those who experience, evaluate or report on open-ended interactive art. That is, we propose these terms as a *common-ground* language to be used by participants communicating while in the art work to describe their experience, by researchers in the various stages of research process (observation, coding activity, analysis, reporting, and publication), and by inter-disciplinary researchers working across the fields of HCI and art. This work builds a foundation for understanding the relationship between free-play, open-ended environments, and interactive installations and contributes sensitising terms useful for the HCI community for discussion and analysis of open-ended interactive art works.

Author Keywords

Free-play, open-ended, interactive installation, common-sense language, sensitising terms, sensitising guides.

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

Feltham et al describe play as a "predominantly open-ended activity with fluid rules of engagement" favouring self-determination and freedom, where game-playing favours competition and ambition ([12] p.63). The emphasis of our research is on free-play, which we define as non-narrative, non-competitive, and without logical ending point. The so-called plot of the play continually evolves in order to keep the play alive [8]. As such, free-play is activity that is constantly rejuvenated, as it is co-constructed and co-authored by its participants and is free from predetermined order or meaning [7, 8, 22].

This paper is framed within the context of three specific open-ended interactive art installations. These open-ended works are free-form in that they provide an abstract yet *embodied* experience that requires their audience to actively construct their own meaning from direct experience with the works. As we have noted, these are non-narrative works, with no prescribed meanings, guidelines or rules to drive the interaction. Neither is there a ready character role for the participant to adopt nor a linear storyline to become engaged in; rather, the participants discover their own motivations and meaning and invent their own interpretations [20].

Games and play have become an important area of research in HCI, with much research generated that examines play within a variety of situations and audiences, with most research focusing on narrative-based, game-type scenarios, and interactive artefacts. Very little research exists on free-play, except in regard to children's open-ended play, and much less research again exists on situated activity in open-ended interactive installation works. In addition, missing from the literature is a discussion of works that set out to provoke play-experimentation-exploration and enable a process of uncovering and meaning-making that encourages initiative on the part of the participants.

We present here a set of sensitising terms that were initially derived from the existing literature and research on play. As Blumer states, sensitising concepts give "the user a general sense of reference and guidance in approaching empirical instances… and suggest directions along which to look" ([6], p.7). To distill sensitising concepts *to use as guides*, to *suggest directions to look* at the related work on play builds sensibly on precedent work. To then use the *guides* as lenses to look through, [4] adds to their usefulness and increases the possibility that they are styled in a *ready-to-use* format. Whether a sensitising concept survives from beginning to end of the process "depends on where the data take us; emergent concepts may supplement or displace them altogether" ([23] p.301). We applied, combined, dropped, added,

refined and amended these sensitising terms on a case-by-case basis to prime them for use for studying participant activity in three chosen works. The terms were designed to assist in the research, analysis, and understanding of interactions in open-ended art works to use as a common language between participants (the general public), for researchers to better understand, code, analyse, discuss, and describe what participants are doing and for inter-disciplinary researchers to use to communicate effectively. As such, these terms need to exhibit a kind of "intersubjective verifiability" or communicability. That is, they need to be both simple enough and evocative enough to offer themselves as a common-sense, common-ground, and above all practical language to each and all of the groups involved in the construction of meaning in these spaces—the artists, the participants, and the researchers. Further coverage is found in "Situated play in open-ended interactive art environments" [19].

In building the sensitising terms to act as guides, we seek to discuss, in more meaningful detail, the kinds of activities people engage in when they interact with open-ended works. As we aim to develop a language that is useful for discussion across multiple disciplines that can also act as a code for analysis (as well as for communicating the results of that analysis), then language becomes doubly useful. If the language can also be useful for participants to unpack and better understand their own experience, as well as for communication with others while in the experience and afterwards, then the usefulness increases yet again. Experiences in an interactive art work are sometimes 'outside of usual life' and can be *heightened* experiences and consequently, people are motivated to communicate with others about these experiences while in them, and often immediately after. The benefit for the artist is in having a useable language and a different set of perspectives to view their work from. These terms or *guides* as language we are developing straddle disciplines. The emerging language (or terms) can act in the same way as a set of boundary objects that fit across the disciplines. Boundary objects—objects that sit between the interfaces of various communities of interest or practice—work because they contain sufficient detail to be comprehensible to more than one of the parties involved and act in a translation or mediation role between the disciplines [30]. The most useful boundary objects often take the form of tangible objects [14], but may also take the form of vocabulary and operate to uncover, test, and push boundaries between fields of practice[16], while also maintaining coherence across intersecting worlds.

The remainder of the paper is structured as follows. After summarising related work, we describe and define the sensitising terms and the process for arriving at the initial terms from the literature and the emergent terms from application. We then describe and analyse participation in three substantial open-ended interactive art works—*Autonomous Light Air Vessels* (ALAVs), *Drafting Poems: Inverted Potentialities*, and *Books of Sand*—that were part of an extensive exhibition at the Interactive Art Program, ACM Multimedia 2006. We also describe the process of defining, testing, and honing the sensitising terms as we analysed participation in these works in order to observe, describe and understand the nature of interaction in open-ended art works. By doing this, we distill initial and emergent terms related to play in order to begin foundational work for the development of a set of common-sense sensitising terms to better describe the situated work of interaction with open-ended works.

RELATED WORK: OPEN-ENDED INTERACTION AND ACTIVATED PARTICIPATION IN HCI RESEARCH

As discussed, 'play' has become a key object of study in HCI over recent years, and has spurred a reconsideration of the dominant concept of 'work.' The growth of research into recreational computing—computing outside workplace environments, including broader cultural and inter-disciplinary applications of computing—feeds into an expanded meaning of what we now understand by the term 'user experience' [4]. Crabtree et al. discuss the importance of considering play as a kind of interaction work and its relevance to Computer Supported Cooperative Work (CSCW) [10]. With the changes in computing use brought about by more widely available access and changes in robustness of ubiquitous computing devices, play and computing (and the situated work this involves) is an important addition to HCI. Moran & Anderson anticipated this progress in their much earlier CSCW research [19], with their emphasis on informal interaction in workaday environments and in the everyday use of mundane technologies. Nonetheless, HCI's interest in play has largely been in regard to narrative-based games that have outcomes and end-points that can more easily be judged as successful or not. Where play is addressed in HCI literature, it tends to be examined either in regard to works with close-ended narrative structures [4, 10, 11] or where free-play is discussed it is largely in relation to children's play in social groups and with artefacts [2, 17, 22]. These are significant studies that provide important background for this paper, particularly where they apply already-established theories of play. However, they also point to two gaps in the HCI literature: first, a gap in relation to open-ended adult interaction in non-narrative based interactive installation (spatial) works, and second, a lack of an overarching framework or language for free-play.

In addition, we argue for a broader understanding that includes the artist's intent (missing and acknowledged as a gap from much HCI evaluation of art works [13]) and the important free-play experiences open-ended interactive art environments afford their participants [8]. Broadly speaking, an open-ended work is one that meets Carse's criteria for an infinite game, as defined in the following section. The artist's intent behind the work is often to create activating and/or exploratory experiences for participants, an aspect largely ignored in HCI evaluations.

IDENTIFYING SENSITISING TERMS FOR FREE-PLAY

We develop an initial vocabulary of sensitising terms for understanding free-play in open-ended interactive art environments. These initial terms derive from research that has been broadly influential to the body of work on play and has contributed key terms that have been taken up and circulated in subsequent research. In addition, we explore philosophies of open-ended works and free play, and from this process derive specific ideas that feed into, support and define a new set of sensitising terms.

Over the last several decades, research on the nature and function of play has increased dramatically across a broad array of disciplines, including sociology, psychology, game theory, and education. Play is of interest to animal behaviourists studying the adaptive advantages of play [3], to developmental psychologists studying the cognitive and social skills that children learn through play [26, 32], and to sociologists studying the way play fits into larger social needs [25]. In the social sciences, early research into play was often delegated or discussed as something children do, and notably as the *work* of children [24]. Piaget's *Play, dreams, and imitation* provides some of the earliest systematic work on play, and continues to act as a touchstone for research into play across the social sciences as well as to much of the HCI research on play. Piaget [26] argued that in play children construct knowledge by a process of assimilation. That is, they fit new experiences into their existing schema, as in the case of a stick becoming a symbolic representation of a sword. Vygotsky [32] in continuing this work, argued that the pretend situation of play creates an imaginative dimension and promotes abstract ideas and verbal thinking. Further, Vygotsky maintained that the toys and gestures with which children play are significant social and cultural artefacts through which children learn social rules and culture. Children's tendency towards play, or playfulness, has been linked to creative thinking skills [17] with research indicating a disposition towards creativity in later life [9].

Parten [25] classified play into various roles including those of: (1) *onlooker*: where a child *observes* others playing and while they may engage in conversation, they do not engage in doing, and focus is on the children at play; (2) *parallel play*: when children play alongside each other with little direct interaction; (3) *associative play*: playing with others without organisation of play activity; initiating or responding to interaction with peers, and (4) *cooperative* play: coordinating one's behavior with that of a peer, and a sense of belonging to a group emerges. Associative and cooperative play roles represent higher levels of interaction where children play together on joint activities and coordinate their actions [25].

Smilansky [28] developed Piaget's work [26] on how children consolidate and extend their prior learning by practicing learnt aspects in their play activities [26], and provided criteria for understanding *dramatic play* The most useful categories for this project include (1) make-believe: play behaviors or speech dialogues and materials or toys substituted for real objects; (2) verbal make-believe: for actions and situations: verbal dialogue takes the place of body movements; (3) interaction: more than one person participates in pretend play episodes; (4) verbal communication: verbal dialogue is exchanged between the players and takes the place of body movements. Embodied interaction can occur through bodily gestural interaction or verbal dialogue. Interaction and verbal communication involve social dynamics in play [28, 29].

Huizinga [15] and Caillois shifted the focus of play from child development to a broader understanding of *ludology* as the foundation of culture. In *Man, play, and games*, Caillois [7] provided a typology of game play, identifying four patterns of play—*agon*, *alea*, *mimicry*, and *ilinx*—which operate on a spectrum that extends from *ludus* (formal, rule-bound game play) to *paidia* (an anarchic state of spontaneous, improvisational form of free-play that is unrestricted and without rules or meaning). More recently, theorists working specifically with free-play-like activities included Carse [8], who distinguished between finite and infinite games (and play), where finite games are played to be won, but an infinite game is played for the purpose of continuing the play.

Paidia, Infinite play, Free-play

For Carse an infinite game features six characteristics that could equally apply as a definition for an open-ended work: (1) an endlessly open outcome; (2) play is dramatic with no scripted conclusion; (3) players do not oppose the actions of others but initiate actions of their own in such a way that others will respond by initiating their own; (4) players allow others to do what they wish in the course of play with them; (5) the length of the game is determined by itself; and (6) the rules continually change to prevent anyone from winning and to bring as many people as possible into play.

Carse views infinite play as the more profound and emotionally evolved activity. A successful open-ended work could facilitate that players initiate actions of their own in such a way that others will respond by initiating their own actions, that the rules continually change to continue the play and to draw others into the play.

Further, Nachmanovitch [22] argues for the profound nature of improvisation and free-play and identifies two types of free-play: *Lila*, a state of divine play, where participants take delight and enjoyment at the simplest of things; and *Bricoleur/ Bricolage* where participants potter about and in the spirit of improvisation, add spontaneously into the play whatever is at hand in the environment. The idea of play—particularly the "meaningless" free-play of Caillois's *paidia,* Carse's infinite play, with no purpose or end-point, or Nachmanovitch's divine state of *lila*—is not always a natural fit within a competitive western society.

Player types and styles

Bartle [1] defined players as types who *played* with different goals in mind. For the purposes of this research, *achievers*, *explorers,* and *socialisers* prove useful terms to consider for understanding free play activity. *Achievers* would always be looking for where things are and what to do. E*xplorers* would seek in a similar way, so these two terms could be conflated. An open-ended work is potentially less of an information space, however some players may have more of a *speculative* approach, looking at the engineering behind the functions of the work and thinking about what else might be possible and/or what works approach things in a similar fashion. *Socialisers* are often the lifeblood of an interactive art experience, interacting and playing with strangers, through the medium of the work and/or about the work.

Dow [11], building on descriptive models of play behavior including Bartle's work [1], names different *player styles* in interactive narrative works. Dow includes the styles (1) *engager:* fully engages with the experience physically, socially, and emotionally; and (2) *observer*: (as with Parten's onlooker): does not interact (or speaks and uses gestures infrequently), watches play unfold. Dow [11] and Bartle [1] caution about typecasting players or styles, since players often change focus [11]. However, Bartle suggests that most players have a primary style, and will only switch to other styles as a (deliberate or subconscious) means to advance their main interest [1].

Initial sensitising terms

We developed the initial sensitising terms from the above literature on play and show the initial set in Table 1. We have outlined above some of the most important concepts we considered when selecting the initial terms. We needed to identify terms that would capture the emergent and evolving play and interaction styles required from participants when interacting in open-ended environments. We understood that open-ended environments do not encourage fixed styles of play. While not all the terms discussed above were selected for the initial set of sensitising terms, the ideas presented feed into and/or were merged with other terms. The sensitiser terms began as a larger batch of ideas and concepts that was gradually refined to form this first initial version (Table 1). The terms were produced in an iterative process of research, design, implement, and reflect. We merged duplicated or similar ideas, erased those that did not apply and grouped potential terms into useful categories for analysing free-form play for the situated instances of use we foresaw could occur in open-ended interactive installations. As this was to some degree unknown territory, we included the already-known free-play terms from play literature, such as Caillois's *paidia,* Carse's infinite play, and Nachmanovitch's divine states of *lila* and *bricolage.* Terms were tested for usefulness by, for example, writing up video analysis code systems, or check lists for observation. Many were systematically removed from the list where they proved redundant, subsequently often triggering more apt terms, which were added. In addition, later in-situ participant observation prompted many sensitiser term ideas (Table 2).

Terms for sensitiser guides compiled from literature	
Observer	Watcher and/or active or non-active observation; often noted with participants at an early stage in approaching the work. [11, 25]
Embodied play	Bodily interaction with others through gesture, body poses, moving around others [28, 29]
Verbal play	Speech with others in the spirit of play, speech that supports the imaginary world of play/ the environment (Smilansky, 1968; Smilansky & Shefatya, 1990; Parten, 1933)
Associative play	Spontaneously initiates or responds in interaction to the initiations of others (Parten, 1933)
Cooperative play	Coordinates with others activities, often forms of role play emerges, for example participants may take turns (Parten, 1933)
Parallel play	Plays alongside others with little direct interaction with others (Parten, 1933)
Lila play	*Lila divine play*: achieves highly optimised state [22] similar to *flow* state with loss of conscious awareness of self and/or time/circumstances
Bricolage play	*Bricoleur*: plays spontaneously with whatever is at hand [22]
Paidia play	*Paidia*: wild, free anarchic play, without rules or 'meaning' (Caillois, 1962)

Table 1: Initial sensitising terms from play literature

In order to make this work accessible and more easily deployable for other research, we systematically drew together the most-used sensitiser guide terms (Table 1) and, following analysis of the interactive works, the emergent common-sense terms (Table 2). The aim was to produce a language that could be used by all those who engage in the process of experiencing, evaluating, or reporting on open-ended interactive art. That is this common-ground language is intended for use by 1) participants in describing their experience of the art work; 2) researchers across the various stages of the research process (observation, coding activity, analysis, reporting and publication); and 3) inter-disciplinary researchers working across the fields of HCI and art. By making sense of everyday talk and action, common sense understandings are produced in a society, and, mutual objective grounding of social facts is accomplished [31]. This research is sparked by an interest to work with 'common sense' as a tool to devise a useful language, "located in our everyday situated actions, such that our common sense... is the product of our interaction" [31] p. 77.

THE ART WORKS

The evaluation presented here is of three open-ended interactive art works that were part of an exhibition of twelve works presented at the Interactive Art Program at ACM Multimedia Conference, 2006. The works were:

(1) *Autonomous Light Air Vessels* (ALAVs), by Nikhil Mitter and Jed Berk, (2) *Drafting Poems: Inverted Potentialities* by Eitan Mendelowitz and (3) *Books of Sand* by Mariano Sardon. We now briefly describe each work, before describing the exhibition, the evaluation methods, analysis and findings.

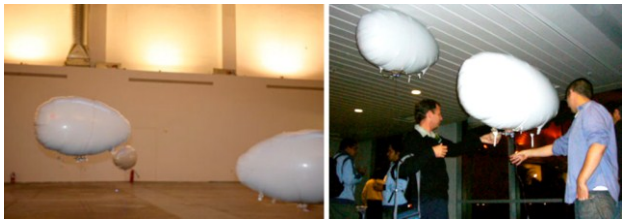

Figure 1. a. ALAVS at the site (©2005-2006. Jed Berk & Nikhil Mitter.) b. Participants feeding the ALAVs. (Image by jed eye roam: Creative Commons).

(1) *Autonomous Light Air Vessels* (ALAVs)–also referred to as blimps or balloons by exhibition participants—are networked functioning objects that fly in the air, built by Nikhil Mitter and Jed Berk, from Art Centre College of Design, Pasadena [5].

ALAVs continually bump gently into people, walls, and objects as they roam about. They make an audible soft sound when left alone for too long, (a mobile phone vibrates against the thin membrane of the ALAV) and require input from people in the form of interactive electronic feeding—their hunger level is indicated by a blue light on their suspended LED (Figure 1). A three-step feeding process switches the LED lights between blue and red. ALAVs interact with people, and each other, and exhibit flocking type behaviour (spinning together and calling back and forth) between themselves and propelling themselves towards each other as they fly about the space.

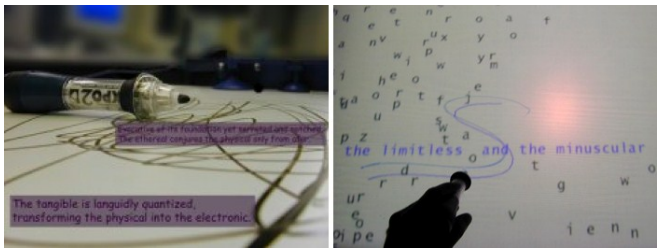

Figure 2. Drafting poems: a. The input pen and examples of phrases. b. The pen in action on the glass top surface. (Images from artists own site and by author at exhibition).

(2) *Drafting Poems: Inverted Potentialities* by Eitan Mendowitz of University of California, Los Angeles works with the idea of an AI aesthetic, building from algorithmic poetry traditions to create meaning by gathering data from participants' sketches on the glass-table top.

The gathered statistics feed into a probabilistic text generation system—an AI system named *The Poet*—that then creates poetic phrases. Users interact with a pen (a dry eraser marker) on an interactive white board (a Mimio). They either draw and add to, or erase markings already on the table. A mix of letters move around on the table, repelled by and attracted to each other, and the input pen, (Figure 2) forming phrases in response to user input. All text objects are tagged with information relative to the user's pen, including the pen's location. In this way, for example, short sentences are produced when the user draws a short line. In addition, as another example, in response to inactivity or delayed input, the work displays words and phrases on topics such as loneliness and despondency. In turn, when input is fast, the work displays related phrases such as *speed* or *sampling error* [18].

Figure 3. a. *Books of Sand* shows movement of hands in sand and text b. two people using the interactive space. (Images from exhibitions and artists own sites).

(3) *Books of Sand,* by Mariano Sardon of Universidad de Tres de Febrero, Buenos Aires is an interactive installation that streams snippets of the work of the 20th-century Argentinian writer Jorge Luis Borges.

The work itself resembles a glass sandbox. When users touch and move the particles of sand as an interactive surface (Figure 3), projected codes and phrases drawn from websites that contain Borges's work rise up in response to the movement of their hands. The words and phrases are projected onto the users' hands and onto areas of the sand. The concept fits into the idea of an infinite work with never-ending possibilities for interaction. The work presents as an interactive dynamic structure that acts as a complex emergent and unpredictable system, echoing the complex, paradoxical nature of Borges's writing. The work itself is inspired by Borges's 1975 short story "El libro de arena," or "The Book of Sand," which tells the story of a book whose pages change with every reading, In Sardon's words, Borges's imagined "book of sand" is "a countless array of pages numbered at random each time it is opened, never the same. The writing is impossible to follow and only reveals fragments of itself as the pages slip uncontrollably through the reader's eager fingers." [27].

THE EXHIBITION EVENT AND THE STUDY

An estimated four hundred people attended ACM Multimedia 2006, and about half of these attended the Interactive Arts Program exhibition opening. Between 70 and 150 of ACM attendees returned for a second visit. The Interactive Arts Program exhibition was open to the public, but the majority of the audience and participants in this study were researchers and artists presenting their work at ACM Multimedia. This multimedia community of practice comprised a mix of academic and industry researchers including artists, engineers, and technologists working around computer vision, graphics, and image processing.

For this study an expert group giving informed feedback was more useful than novice users learning about interactive works [21].

The exhibition covered several floors, accessible by lifts or stairs. Data collection methods comprised sessions of observation, face-to-face discussions, and written questionnaires. These sessions took place at the exhibition-opening event, and during two subsequent return visits to the venue.

Evaluation Method

We interacted with and/or directly observed around 60 people interacting with the works and each other on opening night and on return visits to the exhibition. In addition, we conducted informal discussions with open-ended questions, both in situ during the opening and at subsequent gallery visits, and off site, for instance after the opening, over conference dinners, and at future gatherings and meetings. Further, we gathered 25 formal questionnaires for this exhibition. Ten were from female participants and 15 were from male participants, with ages ranging between 22 and 65 years. Eighteen of the 25 made regular (more than 3) gallery visits each year, and 21 worked in Information Technology or a related or technical field. Questions included, for example, the following: Which work/s did you: 1) Find the most enjoyable? Why? 2) Spend most time with? Why? 3) Play most with? Why?

Detailed reporting from questionnaires and face-to-face discussions is omitted from this paper, largely for reasons of space. Data obtained from these approaches confirmed our observation findings, which for the purposes of this research we found to be richer. We do add instances of data from questionnaires and interviews where relevant.

FINDINGS

In this section, we report on the observed behaviour of participants and the implementation (and expansion) of the sensitising terms where they emerge. The main findings can be summarised as: 1) the participant's experiences were affected by what the work afforded (for example, the different physical constraints of the works led to different types of gestures being used) and 2) the sensitising guides proved valuable tools to use as a common-sense language to better understand and discuss the modes of participation we observed from participants.

We outline and describe below the sensitising terms we found we consistently used to discuss, observe, code, analyse, and/or report the participant experience. We first discuss for each work in turn the nature of interaction we found, including work-specific terms that emerged through the analysis process. We then present the terms, identified in Table 1, that were useful across all three art works. Finally, we define further terms that emerged through data collection, analysis, reporting, and discussion and proved useful to discuss all three art works.

ALAVs

The ALAVs were situated on the entry level to the gallery and were contained within a large open space. In this, at times crowded environment, the ALAVs propelled themselves about, bumping into people and things. The standard response exhibited by participants bumped into by an ALAV was to gently pat or *bat* at the ALAV, and to move it on its way. People *batted* the ALAVs in the same way as they might *bat* a balloon, often just away from themselves, as well as towards others and then a free-play game between those that were bumped into would spontaneously erupt. Depending on the trajectories the ALAVs took, more people might be bumped into and join in with those already participating. If the ALAVs continued to move/ be *batted* into the same area, then the *batters* maintained interest and stayed alert to the play. If the ALAVs moved out of likely *batting* range, then people either returned to their former activities or went in pursuit of the ALAVs. If these same people noticed that the ALAVS came within *batting* range again, then they would automatically join in, often reaching out to *bat* the ALAV without waiting to be bumped into, and, for example, deliberately changing the ALAV trajectory path. A strong sense of camaraderie developed among the ALAV *batters*. Conversations were interrupted with small discussions about the ALAVs erupting, and much smiling and general *goodwill* was evident around the ALAV activity.

For the majority of the participants, *batting* and interacting with others was the total experience of their participation with ALAVs. Instances of *embodied play* (interacts with gestures, body poses etc. with others [29]), *associative play* (spontaneously initiates or responds in interaction with others [25]) and *cooperative play* where participants coordinated with others and types of role play emerged [25], were observed. Participants played socially through interacting with the ALAVs demonstrating an interaction style we named (an emergent sensitising term) *situated social play* [20]. Similar interactions can be witnessed with video recordings of interactions with Andy Warhol's *Silver Clouds,* 1996, available widely on the Web.

Other participants, however, became involved at a deeper level with the ALAVs. These participants sought more information, often from the artists or from other more involved participants in order to actively 'feed' the ALAVs (Figure 1b). They learnt how to do this either through observation and imitation, or having obtained instruction. Most then assumed roles as 'carers' of the ALAVs and noticeable bonds between fellow-feeders formed. Many questions and conversation revolved around an interaction style we named *speculating* (an emergent sensitising term)—in this case, speculating on how the ALAVs worked. Participants often collaboratively speculated until they *comprehended* how the ALAVs worked—an interaction style that also emerged as a sensitising term. We found instances of *situated social play* through the work that included *verbal, embodied, associative,* and *cooperative play,* as well as an interaction style we named

interactive play (an emergent sensitising term) (directly engaging and actively playing with the work), *speculation* and *comprehension*. The ALAVs certainly delighted people, and participants appeared charged (perhaps in a state of *lila)* from their play interactions with them and other participants.

Drafting Poems

An informal, shifting community emerged around this work, and individuals and groups of people tended to linger around the glass-topped drafting table. Participants appeared comfortable approaching and interacting with *Drafting Poems*, whose mode of interaction is based on broadly common and everyday learned actions—in this case, using a pen and eraser on a writing surface. Participants also appeared comfortable *handing over* the pen or eraser to the next person, and judging by observation and participant feedback, interaction with *Drafting Poems* was straightforward and its mode of use was unambiguous. The manner in which each participant drew on the glass top, however, produced markedly different results, and consequently most people experimented with how to create different effects. As with the ALAVs, *Drafting Poems* prompted many discussions that revolved around *speculation* on how the installation worked. Participants both espoused and tested theories, trying their own experiments or attempting to emulate the results of another. Participants and observers used *deictic gestures* to point to words, the pen, the eraser and/or movement of words on the display. People were often sensual in their actions, building and/ or erasing phrases with flowing motions. Others were more overtly performative with a larger-than-life-ness to their gestures.

We observed that people actively participated with the work. They would actively engage in *interactive play, embodied play* and/or, *observe* and/or discuss others' activities (*verbal play*). The behaviour was much like that found at a board game, where a limited number of players can be active at any one time (there was only one pen and one eraser), but where many people could be involved with the 'moves'. Unlike players in a board game, these participants could agilely exchange roles and were not confined to set durations or roles of play. *Interactors* also engaged in *associative* and *cooperative play* and people socially interacted through the work (*situated social play)*. Participants also commented on the results themselves, with outbreaks of laughter or exclamations of surprise. Humour or self-deprecation about responses was common, with participants stating for example: "I only got sad words, what does it mean?" or "I can never catch the letters, they move too fast and then they mock me with phrases about speediness" and similar.

Books of Sand

We observed that, as with *Drafting Poems*, participants gathered around the *Books of Sand* installation, exhibiting *verbal, embodied, associative* and *cooperative* play. The interaction here—with the sand and projection—was different to *Drafting Poems,* in that the participants interacted with random phrases, whereas at *Drafting Poems,* their motion could affect which phrases emerged. The interactivity subsequently took on a different quality with *Books of Sand.*

Again, this was a work where participants appeared rapidly to understand what to do with the installation and how to interact with it. As with the ALAVs and *Drafting Poems*, *Books of Sand* relied on simple, everyday manual motions. In this work, a participant simply moves their hand above or in the sand, which causes words to be projected onto their hands. Consideration of and moving around the hands of others sharing the same space seemed to occur naturally.

There is a sensual quality to a work that requires participants to interact by moving their hands around in or above a pile of sand. With this work, the participants' gestures became sensual, more considered, and slower in pace. This was for a variety of reasons. The gestures generally required finer motor actions: to move one's hands in any other way would have disrupted the work in a contained space. Participants needed to coordinate and negotiate around each other's hands (while in motion) to avoid bumping into each other. Moreover, it would have been physically difficult to move fast, and/or with large gestures with hands in the sand within the confines of the glass box. In reading the uncovered words or phrases, the work gained a contemplative quality. As with many works, only a limited number of people could fit around the work and be active in it at any given time (in this case 3 or 4 people, depending on the size of the people and how comfortable they were in being in close proximity with others; this is something that the participants self-managed). Participants and observers used *deictic gestures* to point to words and phrases in the projections, often pointing while reading aloud. Participants appeared to be mesmerised by the work to some degree, although they still entered into dialogue and exclaimed or repeated phrases or words as they appeared on top of their hand.

Participants engaging directly with the work (the *interactors*), took time to read the words and appeared to enjoy the sensuality of the sand and the aesthetic visual presentation of letters projected onto the top of their hands. In addition, conversations with others began easily since, as they had with *Drafting Poems*, the words and phrases, as well as the ways to interact, generated conversation and *speculation.* People gathered in the space around the work and waited their turn, or discussed, while observing others, and *comprehended* the work. People engaged in *verbal* and *embodied play,* they socialised with others through the work (*situated social play*), and they generally participated in *associative* or *cooperative* play with others at the work at the same time. Although this work generated discussion, most participants appeared to be quieter, more reflective, and more sensually engaged when observing and interacting with the work.

Emergent sensitising terms from participant observation	
Situated social play	Participants engage with others through the work. Forms of play that take place ***with*** others and ***through*** the work. Participants may gesture towards the work and/or discuss the work, so social communication is mediated through the work as a proxy. While this category could easily be shortened to *social,* the emphasis of social through the work may be lost by doing so. *Situated social* play can occur by verbal, embodied, associative and/ or cooperative play—even with *lila* and *paidia* play.
Interactive play	*Active interaction mode,* where *interactors,* (the participants) actively engage with the work through the modalities afforded by the work. The *interactors*—are engaged and invested in their interacting (they are beyond 'just looking'). The interactors were often spurred on by verbal play and the interjections of others to try new or different ways of interacting. *Interactive play* can occur through verbal, embodied, associative and/ or cooperative play—even with *lila* and *paidia* play.
Speculative play	Participants actively figure out how something works—both the conceptual and the technological aspects of the work—with testing and debating various theories; often done in collaboration with others/strangers. S*peculative play* can occur through verbal, embodied, associative and/ or cooperative play, even with *lila* and *paidia* play.
Comprehension	A stage or mode where participants attain *getting* the work, (conceptually and/or technically); *speculation* is complete. There were often several stages involved in achieving a general comprehension of the work.
Participants switched easily between, *observation, speculation* and *comprehension* or *interaction* as states of engagement and play	

Table 2: Emergent terms from application of sensitiser guides after observation and analysis of participation

Summary of findings

Across the three works, we observed that participants interacted with the works with varying degrees of embodied interaction. In interacting with *Books of Sand*, participants often used slow, sensual hand gestures, exhibiting fine motor control, particularly when more than one participant was active at a time. Participants interacting with *Drafting Poems* also exhibited fine motor control while experimenting with interacting at a variety of speeds and levels of intensity and using *deictic* gestures to interact with the work and other participants. In interacting with the ALAVs, participants used hand gestures, full body gestures (leaping to catch and pass on the blimp) and/or fine gesture movements for feeding or *batting* the blimp.

Overall, the works inspired conversations and discussions, and resulted in people experimenting, speculating, and freely playing within them. Importantly, the pen, the sand and the balloon/blimps, are familiar-enough and readily understandable interactive objects. That is, we know what to do with them and how to make them work. The gestures required to interact with the artworks replicate everyday manual activities common to most people. Because participants have already learnt what to do with similar tools, and because these tools provide the primary interaction access point into the works, it follows that the works enable ready access to their participants.

From the questionnaires and oral interviews, participants reported that the aesthetics attracted them to the works, and that they chose works as favourites. Additionally, there was a generally positive response to conceptual difficulty; for example, participants commented that "[the] difficulty [of the work was] not necessarily bad" and that "difficulty wasn't the reason to not stay" and continue interaction.

The sensitising guides provided a useful focus for observation, data collection, analysis, evaluation, reporting, and discussion of participant activity, and they provided a common-sense language to discuss the interaction work of free-play.

We can draw four main conclusions here:

(1) Familiar-enough interactive artefacts enabled easy entrance and an overall simplicity of use.

(2) Participants interacted with the works through varying degrees of gesture and/or movements of their full bodies, in an effort to interact with what the works afforded.

(3) Most participants were involved in some form of *situated social play* through the work at the exhibition.

(4) The sensitising terms proved useful to identify, analyse, and discuss detailed modes of interaction (see Table 2).

DISCUSSION: SENSITISING TERMS IDENTIFY ACTIVITY MODES

A number of key sensitising terms were repeatedly identified as useful across all three works. Significantly, these highlighted or pointed to social acts of observing and playing with others around and through the open-ended works. The predominantly used terms comprised a mixture of terms identified in the literature and terms emergent upon application. We compile here the initial commonly used and the emergent terms.

Literature-derived sensitising terms used for all works

1. *Observation*
2. *Verbal play*
3. *Embodied play*
4. *Associative play*
5. *Cooperative play*

A predominant activity mode identified in Table 1 was the *observer* role. However, as with all roles (and as signaled by Bartle [1] and Dow [11]), we found participants switched agilely between identified modes of play and participation. Other initial sensitiser terms that we found occurred across all three installations were *verbal play* (speech with others in the spirit of play) [25, 29], *embodied play* (interaction with others through gesture and body poses) [29], and *associative play*, whereby a participant spontaneously initiates or responds in interaction with others [25]. Additionally, when play became more established and ongoing, *associative play* changed into *cooperative play*, where participants coordinated with others and types of role play emerged [25].

Emergent sensitising terms used for all works

In addition to the initial terms, we also found a number of sensitising terms emerged from our grounded analysis of people's interactions with all three open-ended works. These are listed below and detailed in the individual analyses and Table 2:

1. *Situated social play*
2. *Interactive play*
3. *Speculative play or speculation*
4. *Comprehension*

Further, we often observed deictic gesturing as a mode of interaction, where participants used fine-muscle hand movements in smaller confines, pointing towards displays or interactive objects in the interactive spaces

Sensitising terms focus the analysis and discussion

The most consistently used of the sensitising guides throughout were the terms *embodied play, verbal play*, and *observation*. The emergent common-sense terms that were most frequently adopted across all three art works were the terms *situated social play, interactive play*, *speculation* or *speculative play* and *comprehension*. The term *bat* was a term used to describe activity specific to interaction with the ALAVs, a situated instance of use, which may be useful for other gesture-based works that use flying objects. Less frequently used in this context (but useful nonetheless, particularly to social and group work) were terms such as *associative* and *cooperative play*. *Lila* arose in one instance, and was often indicated by what appeared to be heightened states of play with all three works. We can say that participants joined into the spirit of play (which infers by its very nature working with whatever is at hand—acts of *bricolage*).

The three interactive art installations are open-ended non-narrative works that engage their participants in some form of free play, explorative play, or *paidia,* with the work and require their participants to play freely with their physicality (the artefact nature). However, there are orchestrated moves that the works set up, a set of prescribed movements or activities that trigger the works. These are not entirely 'open' spaces for interpretation, rather they are scoped to enable certain activities and hopefully allow the player's imaginative response to more abstract meanings. An aim is for participants to play freely with others, initiate actions that allow others to do the same and to bring as many people as possible into the play. In order to generate a successful experience, participants need to be able to interact autonomously and have some kind of motivation to act there. So as to determine this purpose, many participants *observe, interact* and appear to try to *comprehend* the works, to *speculate* some kind of theory that they then test and subsequently continue to adapt from what they find in their testing and/or speculating. Open-ended interactive works require conceptual thinking on the part of the participants. The sensitising terms proved useful in identifying these characteristics and interaction styles. From batting around ALAVs, running fingers in the sand with *Books of Sand* and chasing words in *Drafting Poems,* the works acted in varying degrees to activate their participants in their exploration of the works.

Regardless, these sensitising terms need to be used with a caveat of understanding their own situatedness. That is, the terms need to be applied on a case-by-case basis, and understood in terms of the larger discussion, both from the broad inter-disciplines from which these terms derive [20], and as they emerge and adapt by in-situ use.

The sensitiser terms portrayed (Tables 1 & 2) are those that were most often used and useful for priming observation, analysis and discussion (what to look for when observing people) throughout the study. These common-sense sensitising terms are terms that were either identified in the initial sensitiser guide terms (from play literature) and/or that emerged as being the most useful terms (and the most used) to describe the participant's observable interaction with the open-ended installation works (what it is that people did there). That is, these common-sense terms proved useful to better describe the finer detail and stages of engagement and interaction observed while watching participants at various levels and degrees of engagement with the works. The level of engagement deepens for the participants as we drill down into the table. The first stage is usually *observation* (Table 1) and most, but not all participants, who engage for any length of time go through all of the stages that comprise what it is that people do when interacting with open-ended interactive works.

CONCLUSION

In this paper we have discussed the nature of free-play in open-ended interactive environments in the context of three interactive multimedia installations. The perceived frivolity of the area has restricted study relative to other areas in HCI research. Better understanding here is increasingly important, however, as everyday interactions with technology leave behind more structured workflows and enter the more spontaneous, open-ended, exploratory and informal workaday world of ubiquitous computing.

To help establish further research into this area, we introduced a set of sensitising terms, derived from the literature on play and emergent from grounded application, which can act as a lens on people's interactions in open-ended environments. We have found that these sensitising terms were useful for observing, recording, analysing, reporting, and discussing participation and free-play in these situated open-ended interactive art installation works. The same terms can also be used by the participants who interact with the work; and discuss their interaction with each other, strangers at the work, the artist and/or the researcher. The sensitising terms can then be employed as a common-ground language for use to communicate meaningfully between inter-disciplinary researchers. Our intention is that these terms can be used for further analysis of embodied interaction in open-ended environments, and to build the foundation for a common-sense language that

through reflection, application and use, allows the continual addition of new common-sense terms for use as sensitising guides that are applicable in specific and broader contexts.

The work and methods reported here provides a foundation for future work to establish a stronger understanding of the language to describe—and relationship between—free-play, open-ended environments, and design for technologies that support engagement, as ubiquitous technologies become more prevalent in our everyday lives.

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